TEST REPORT

EN 60529:1991+A1:2000+A2:2013
Degrees of protection provided by enclosures (IP Code)

Report Reference No.:	422879-1TRFEnvEx This report cancels and replaces the one issued with ref. no. 422879TRFEnvEx
Tested by (name, function and signature) ..... :	Cristian Simone (Project Handler)
Approved by (name, function and signature) ..... :	Emiliano Porcu (Verifier)
Date of issue:	2021-10-28
Testing Laboratory:	**Nemko Spa**
Address:	Via del Carroccio, 4 I – 20853 Biassono (MB)
Testing location/ address:	Nemko Spa – Via del Carroccio, 4 I – 20853 Biassono (MB)
Applicant's name:	Aesys SpA
Address:	Via Artigiani 41 24060 Brusaporto BG Italy
Test specification	
Standard:	EN 60529:1991+A1:2000+A2:2013
Testing procedure:	Full application of standards ☒ Partial application of standards ☐ Other standard testing methods ☐ Non-standard testing methods ☐
Non-standard test method:	N/A
Test Report Form No.:	TRFEnvEx
TRF Originator:	Nemko S.p.A.
Master TRF:	2021-01

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Test item description:	Monitor
Trade Mark:	aesys
Manufacturer:	Same as applicant
Model/Type reference:	993202033501– CPTOU4615 LS P3L3ARIO2H-4G1WTTSPFAEZ0
Ratings:	220-240 Vac 50/60 Hz Class I
Test Report distribution index.:	2021-10-28

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The test report merely corresponds to the test sample.
The phase of sampling / collection of equipment under test is carried out by the customer.
Results indicated in this test report apply to samples as received.

This Test Report, when bearing the Nemko name and logo is only valid when issued by a Nemko laboratory, or by a laboratory having special agreement with Nemko.

Test Report No. :	422879-1TRFEnvEx

Short description of the EuT	Copy of marking plate
Monitor.	

Number of tested samples:	1
Serial number:	000000
Brand	aesys
Manufacturer	Same as applicant
Model	993202033501– CPTOU4615 LS P3L3ARIO2H-4G1WTTSPFAEZ0
Manufacturer year	n.d.
Ratings	-
Accessories and detachable parts included/ Mounted tool:	The E.U.T. is composed by a single unit
Other options included:	None

Testing

Date of receipt of test sample:	2021-07-15
Testing commenced on:	2021-10-25
Testing concluded on:	2021-10-25

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

Test Result according to the customer criteria of acceptance in § 4.4:	**PASS**

PROJECT HISTORY		
Report number	**Modification to the report / comments**	**Date**
422879TRFEnvEx	First release	2021-10-25
422879-1TRFEnvEx	Typing error	2021-10-28
REMARKS		
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1 TEST PERFORMED

Tests performed to check degrees of protection provided by enclosures. The IP65 test were performed.

2 TEST STANDARDS AND PROCEDURES

- **NEMKO WM L0177:**
  General routines for using instruments at Nemko
- **NEMKO WM L1002:**
  Measurement Uncertainty - Policy and Statement
- **EN 60529:1991+A1:2000+A2:2013**
  Degrees of protection provided by enclosures (IP code)
- **NEMKO WM L0068**
  IP protection measurements according to 60529

3 General remarks:

The IP6X test was performed in accordance with clauses 5, 12.2, 13.4 and 13.6.1 of EN 60529. Acceptance criteria were as required on clauses 12.3 and 13.6.2 of EN 60529.
The IPX5 test was performed in accordance with clauses 6 and 14.2.5 of EN 60529. Acceptance criteria were as required on clause 14.3 of EN 60529.

3.1 Environmental conditions

Unless different values are declared in the test case, following ambient conditions apply for the tests:

Ambient Temperature:	18 ÷ 33° C
Relative Humidity:	30 ÷ 70 %
Atmospheric pressure:	860 ÷ 1060 hPa
Water temperature:	T_{amb} - 4°C

3.2 Measurement uncertainty

The measurement uncertainty was calculated for all measurements listed in this test report according to Nemko Spa Technical Procedure WM L1002 and is documented in the quality system acc. to EN 17025. The manufacturer has the sole responsibility of continued compliance of the device.

Test	Range	Measurement Uncertainty	Note
Environmental testing	Temperature -70 °C ÷ 180 °C – Chamber center	1.4 °C	(1)
	Temperature -70 °C ÷ 180 °C – Overall chamber	1.8 °C	(1)
	Relative Humidity 10 % ÷ 98 % – Chamber center	3 %	(1)
	Relative Humidity 10 % ÷ 98 % – Overall chamber	4 %	(1)
IP protection	Water flow 0.5 l/min ÷ 100 l/min	5 %	(1)
	Air flow	5 %	(1)
	Force 50 N, 30 N, 3 N, 1 N	6 %	(1)
	Dimensions 50 mm, 12.5 mm, 2.5 mm, 1 mm	0.05 mm	(1)
Construction verifications	AC/DC Voltage 10 mV ÷ 1000 V up to 5 kHz	1.5·%	(1)
	AC/DC Voltage 10 mV ÷ 1000 V 5÷100 kHz	2.5·%	(1)
	AC/DC Current 0.1 mA ÷ 5 A up to 1 kHz	1.5·%	(1)
	AC/DC Current 5 A ÷ 400 A up to 1 kHz	2.5·%	(1)
	Resistance 100 mΩ ÷ 10 MΩ	2.0·%	(1)
	Active/Apparent Power 200 mW ÷ 1 W	20 mW	(1)
	Active/Apparent Power 1 W ÷ 6 kW	3.0 %	(1)
	Power factor	0.05	(1)
	Frequency	0.2 %	(1)
	Dimensions 0 ÷ 200 mm	0.05 mm	(1)
	Dimensions 0.2 ÷ 200 m	0.5 %	(1)
	Angle and Inclination 0 ÷ 360 °	0.3 °	(1)
	Force 0.2 ÷ 2.5 kN	3 %	(1)
	Torque 0.1 ÷ 200 Nm	5 %	(1)
	Mechanical energy 0.2 ÷ 50 J	10 %	(1)
	Weight 1 g ÷ 2 kg	1.0 % or 0.1 g	(1)
	Weight 2 kg ÷ 100 kg	2 %	(1)
Heating	Temperature 20 °C ÷ 400 °C	4.5 °C	(1)
Pressure measurement	Pressure -0.5 bar ÷ 700 bar	1.0·%	(1)
Temperature measurement	Temperature -40 °C ÷ 300 °C	2.0 °C	(1)
Protection against access to live parts	Dimensions 1 ÷ 1000 mm	0.08 mm or 0.3 %	(1)
	Force 0.2 ÷ 1000 N	3%	(1)
Power input and current	Active/Apparent Power 0.2 W ÷ 6 kW	20 mW or 3 %	(1)
	AC/DC Current 1 mA ÷ 5 A up to 1 kHz	1.5 %	(1)
Leakage and touch current	AC Current 0.01 mA ÷ 200 mA up to 500 Hz	3.5 %	(1)
	AC Current 0.01 mA ÷ 200 mA 0.5 kHz to 5 kHz	5.0 %	(1)
	AC Current 0.01 mA ÷ 200 mA 5 kHz to 100 kHz	10.0 %	(1)
	AC Current 0.01 mA ÷ 200 mA 100 kHz to 1 MHz	20.0 %	(1)
Earth impedance	Impedance 1 mΩ ÷ 10 kΩ	3 mΩ or 4 %	(1)
Continuity resistance	AC 10 mΩ ÷ 2 Ω, 5 A ÷ 32 A	3 mΩ or 5 %	(1)
	AC 2 Ω ÷ 100 Ω, 100 mA or 200 mA	5 %	(1)
	DC 1 mΩ ÷ 1 kΩ, 0.01 A ÷ 10 A	5 %	(1)
Insulation resistance	10 kΩ ÷ 200 GΩ, 10 V ÷ 1000 V	3.0·%	(1)
	200 GΩ ÷ 1000 GΩ, 500 V ÷ 1000 V	5.0·%	(1)
Dielectric strength	AC Voltage 0.1 kV ÷ 5 kV (50 Hz or 60 Hz)	3.0 %	(1)
	DC Voltage 0.1 kV ÷ 6 kV	3.0 %	(1)
	AC/DC Current 0.1 mA ÷ 200 mA up to 1 kHz	5 %	(1)
Transients	Pulse voltage	10·%	(1)
EMF	-	25 %	(1)
Plug discharge	Voltage	5 %	(1)
Working voltage	Voltage	5 %	(1)
	Frequency	5 %	(1)
Tracking test	Voltage, Current	1.5 %	(1)
	Drops - count	7	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %

Test	Range	Measurement Uncertainty	Note
Moisture resistance	See Environmental testing and IP protection		(1)
Overload protection	See Construction verifications and Heating		(1)
Abnormal operation	See Construction verifications and Heating		(1)
Mechanical strength	Force 0.2 ÷ 2.5 kN Length 1 ÷ 1000 mm	See Construction verifications	(1)
Resistance to heat and fire (Glow wire test)	Glow wire temperature	5 °C	(1)
Resistance to heat and fire(Ball pressure test)	Ball pressure dimension	0.1 mm	(1)
Time Measurements	10 ms ÷ 8 h	1 %	(1)
Velocity Measurements	0 ÷ 5 m/s	5 %	(1)
Salt mist	See 60068-2-11	(2)	(1)
Vibration	5 Hz ÷ 2 kHz	5.0 %	(1)
Sound power/pressure level	31 Hz ÷ 4 kHz	3.0 dB	(1)
	4 kHz ÷ 10 kHz	6.0 dB	(1)
	A-weighted, C-weighted	2.0 dB	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %
(2) The instruments used for this test is according to the tolerances requested by the standard 60068-2-11

Test	Range	Measurement Uncertainty	Note
Radiance Blue light, Retinal thermal, Retinal thermal weak visual stimulus	0 ÷ 0.1 MW/(sr·m²) 300 ÷ 1400 nm	7.0 %	(1) (4)
	0.1 ÷ 100 MW/(sr·m²) 300 ÷ 1400 nm	8.0 %	
Luminance	0 ÷ 0.1 Mcd/m²	7.0 %	(1)
	0.1 ÷ 100 Mcd/m²	8.0 %	
Irradiance Actinic UV, Near UV, Blue light small source, IR radiation, eye	0 ÷ 0.1 MW/(m²) 200 ÷ 300 nm	9.2 %	(1) (5)
	0.1 ÷ 100 MW/(m²) 200 ÷ 300 nm	10.0 %	
	0 ÷ 0.1 MW/(m²) 300 ÷ 3000 nm	6.4 %	
	0.1 ÷ 100 MW/(m²) 300 ÷ 3000 nm	7.2 %	
Illuminance	0 ÷ 20 klx	4.0 %	(1)
Spectral Radiance	0 ÷ 0.1 MW/(sr·m²·nm) 300 ÷ 1400 nm	6.2 %	(1)
	0.1 ÷ 1 MW/(sr·m²·nm) 300 ÷ 1400 nm	7.0 %	
Spectral Irradiance	0 ÷ 0.1 MW/(m²·nm) 200 ÷ 300 nm	8.6 %	(1)
	0.1 ÷ 1 MW/(m²·nm) 200 ÷ 300 nm	9.2 %	
	0-0.1 MW/(m²·nm) 300 ÷ 3000nm	5.4 %	
	0.1 ÷ 1 MW/(m²·nm) 300 ÷ 3000 nm	6.4 %	
Radiant power Laser radiation Output power	350 ÷ 400 nm 950 ÷ 3000 nm 30 uW ÷ 30 W	9.0 %	(1), (2), (3)
	400 ÷ 950 nm 50 nW ÷ 3 W	4.6 %	(1), (2), (3)
Radiant energy Laser radiation	350 ÷ 400 nm 950 ÷ 3000 nm 20 uJ ÷ 2 J	9.0 %	(1), (2)
	400 ÷ 950 nm 20 uJ ÷ 2 J	4.6 %	(1), (2)
Wavelength	200 ÷ 3000 nm	4.5 %	(1)
Length in optical measurement	0 ÷ 20 mm	0.5 mm	(1)
	20 ÷ 200 mm	2 mm	
	0.2 ÷ 200 m	0.5 %	

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %
(2) In the standard 60825-1 laser radiation can indicate radiant power or radiant energy
(3) In the standard 60825-1 the radiant power can be called also output power
(4) The uncertainty value expressed in W/(m²) is the maximum value between the value measured and the limit stated in the standard (see IEC/EN62471) multiplied to the measurement uncertainty stated in the table
(5) The uncertainty value expressed in W/(sr·m²) is the maximum value between the value measured and the limit stated in the standard (see IEC/EN62471) multiplied to the measurement uncertainty stated in the table

Test	Range	Measurement Uncertainty	Notes
Radiated Disturbance 10m Chamber	Antenna distance 3 m, 10 m 0.009 ÷ 200 MHz	5.0 dB	(1)
	Antenna distance 1 m, 3 m, 10 m 200 ÷ 1000 MHz	5.2 dB	(1)
	Antenna distance 1 m, 3 m, 10 m 1 ÷ 6 GHz	5.2 dB	(1)
	Antenna distance 1 m, 3 m 6 ÷ 18 GHz	5.5 dB	(1)
	Antenna distance 1 m, 3 m 18 ÷ 40 GHz	7.2 dB	(1)
Radiated Disturbance with large loop antenna system (LLAS)	0.009 ÷ 30 MHz	3.3 dB	(1)
Conducted Disturbance	0.02 ÷ 150 kHz with AMN	3.8 dB	(1)
	150 kHz ÷ 30 MHz with AMN	3.4 dB	(1)
	150 kHz ÷ 30 MHz with AAN	4.6 dB	(1)
	9 kHz ÷ 30 MHz with voltage probe	2.9 dB	(1)
	150 kHz ÷ 30 MHz with current probe	2.9 dB	(1)
Clicks	9 ÷ 150 kHz	3.8 dB	(1)
	150 kHz ÷ 30 MHz	3.4 dB	(1)
Disturbance Power	30 MHz ÷300 MHz	4.5 dB	(1)
Frequency	10 Hz ÷ 1 kHz	0.2 %	(1)
	1 kHz ÷ 40 GHz	10^{-6}	(1)
Harmonic Current Emission	50 Hz ÷ 2 kHz	3 %	(1)
Fluctuation and Flickers	Fluctuation (d%)	0.05 %	(1)
	Flickers (Pst)	5 %	(1)
Radiated Immunity Anechoic Chambers	20 MHz ÷ 6 GHz	3.4 dB	(1) (3)
Radiated Immunity TEM Cell	0.01 ÷ 200 MHz	3.0 dB	(1) (3)
Bulk Current	1 ÷ 200 MHz	3.0 dB	(1)
Immunity to conducted disturbances	9 kHz ÷ 230 MHz	3.0 dB	(1)
ESD Immunity	Voltage, Current, Rise time, Duration	(2)	(1)
Burst Immunity	Voltage, frequency, burst period and duration, rise time and pulse width	(2)	(1)
Surge Immunity	Voltage, Current, Rise time, Duration	(2)	(1)
DIPS, Interruption and Voltage duration Immunity	Amplitude	5 %	(1)
	Duration	5 %	
Impulse Magnetic Field Immunity	Peak Current	10 %	(1)
	Rise time, Duration	20 %	(3)
Power Frequency Magnetic Field Immunity	16.7 Hz, 50 Hz, 60 Hz	2.0 dB	(1) (3)
Damped Oscillatory Wave Immunity, Ring Wave Immunity	Voltage, front time, frequency 100 kHz, 1 MHz	(2)	(1)
Damped Magnetic Field	Amplitude: 100 kHz, 1 MHz	3 dB	(1)
	Frequency: 100 kHz, 1 MHz	10 %	
Low Frequency Immunity	15 Hz ÷ 150 kHz	2.2 dB	(1)
Automotive transients Immunity	Voltage, rise time, duration time Impulses 1, 2a, 2b, 3a, 3b and 4	(2)	(1)
Automotive transients Emission	Amplitude, Time	10 %	(1)
EMF for Lighting Equipment	-	25 %	(1)
Electromagnetic fields (EMF)	Magnetic, Electric and Electromagnetic fields: 0 Hz ÷ 40 GHz	25 %	(1)
Electrical quantities (voltage, current, resistance)	AC/DC Voltage 10 mV ÷ 1000 V 0÷100 kHz AC/DC Current 0.1 mA ÷ 400 A 0÷1 kHz Resistance 100 mΩ ÷ 10 MΩ	2.5 %	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %
(2) The instruments used for this immunity test is according to the tolerances requested by the applicable standard
(3) The reported expanded uncertainty of measurement is related to the stimulus quantity

3.3 Assessment of conformity

The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:
P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.
F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

4 EQUIPMENT UNDER TEST

4.1 Power supply system used

Power supply voltage	:	o 230V/50 Hz / 1ϕ	o 115V/60Hz / 1ϕ
		o 400V/50 Hz 3PE	o 400V/50 Hz 3NPE
		o 12 V DC	o 24 V DC
		■ Equipment not supplied during the tests.	

4.2 EuT operation mode

The device was placed according to the customer's request.

4.3 EuT configuration:

The EUT has been tested as provided by customer

4.4 Acceptance Criteria

The test results shall be classified in terms of loss of protection or degradation of protection of the EuT, referred to a performance level defined by the standard and the relevant degree of protection.

Required performance level based on EN 60529.
The EUT shall comply with the following requirements:

§ 12.3 The access probe shall not touch hazardous live parts.

§ 13.6.2 The protection is satisfactory if no deposit of dust is observable inside the enclosure at the end of test

§ 14.3 No deposit of water inside the enclosure at the end of the test or if the any water has entered, it shall not:

- Be sufficient to interfere with the correct operation of the equipment or impair safety;
- Deposit on insulation parts where it could lead to tracking along the creepage distances;
- Reach live parts or windings not designed to operate when wet;
- Accumulate near the cable end or enter the cable if any.

5 TEST CONDITIONS AND RESULTS

5.1 IP6X

Test probe .....: 1 mm dia.

Force applied .....: 1 N

Volume EuT.....: 0,25 m^3

Test duration .....: 8h [1)]

Depression .....: 2,0 kPa (20 mbar)

Talcum powder .....: 2 kg/m^3

Extraction rate 10 volume/h

Instruments used: see section 6.

5.1.1 Description of the test location

Test location: Nemko Spa

5.1.2 Photo documentation of the test set-up

a)

b)

Figure 1: a) The EUT inside the dust chamber: b) after the IP6X

5.1.3 Test result

The requirements are: **Fulfilled**

The test probe doesn't penetrate inside the enclosure nor touch hazardous part.
At the end of test no dust has been found inside the enclosure.

Remarks and/or Deviations: None

5.2IPX5

Water flow rate .....: 12,5 l/min

Duration of test .....: 3 min

Rotation speed .....: 1 turn/min

Nozzle diameter .....: 6,3 mm

Distance .....: 3 m

Temperature water .....: 20,8 °C

Temperature sample .....: 21,4 °C

Instruments used: see section 6.

5.2.1 Description of the test location

Test location: Nemko Spa

5.2.2 Photo documentation of the test set-up

a)

b)

c)

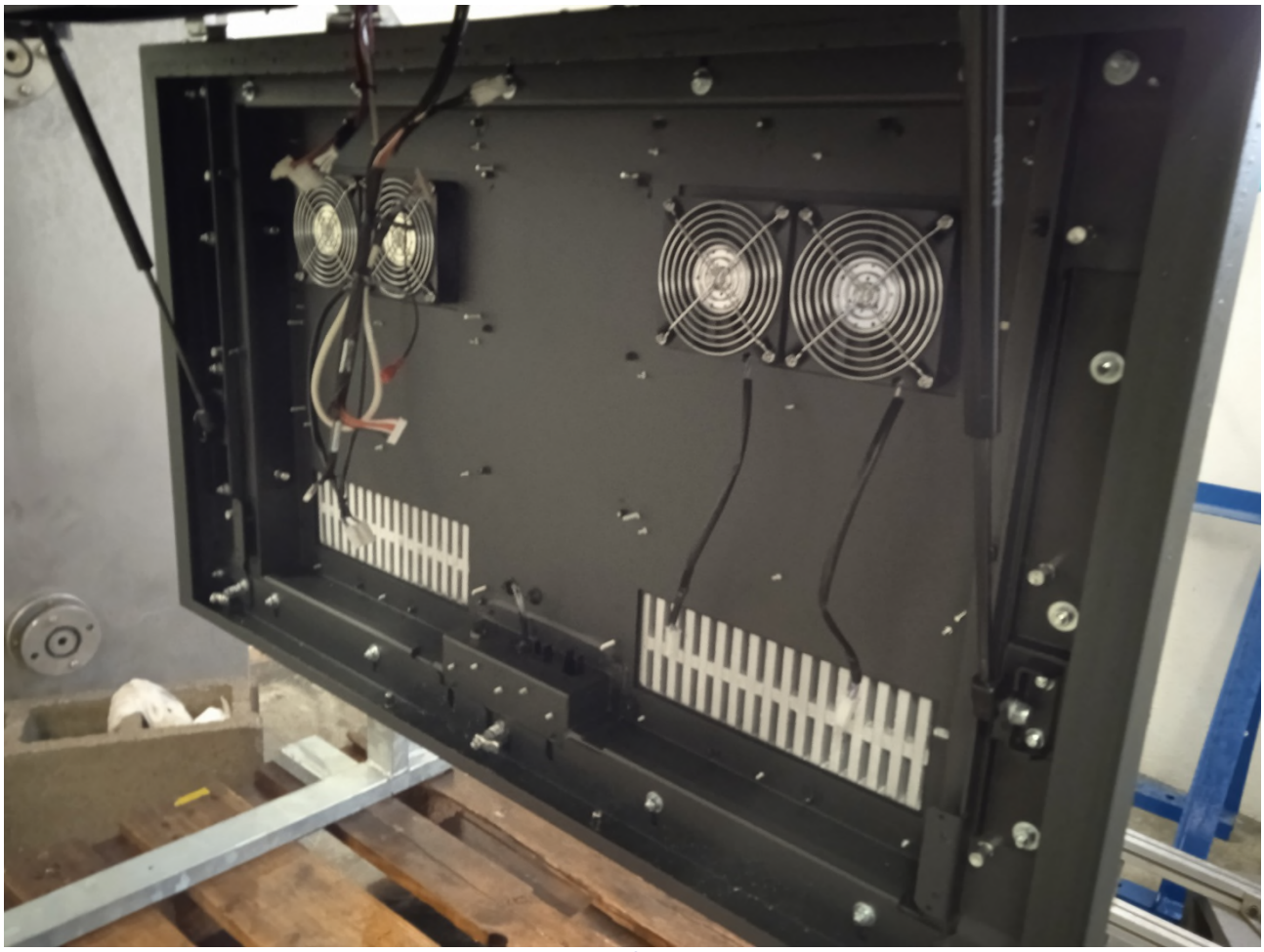
Figure 2: from a) to c) EuT during IPX5 test

5.2.3 Test result

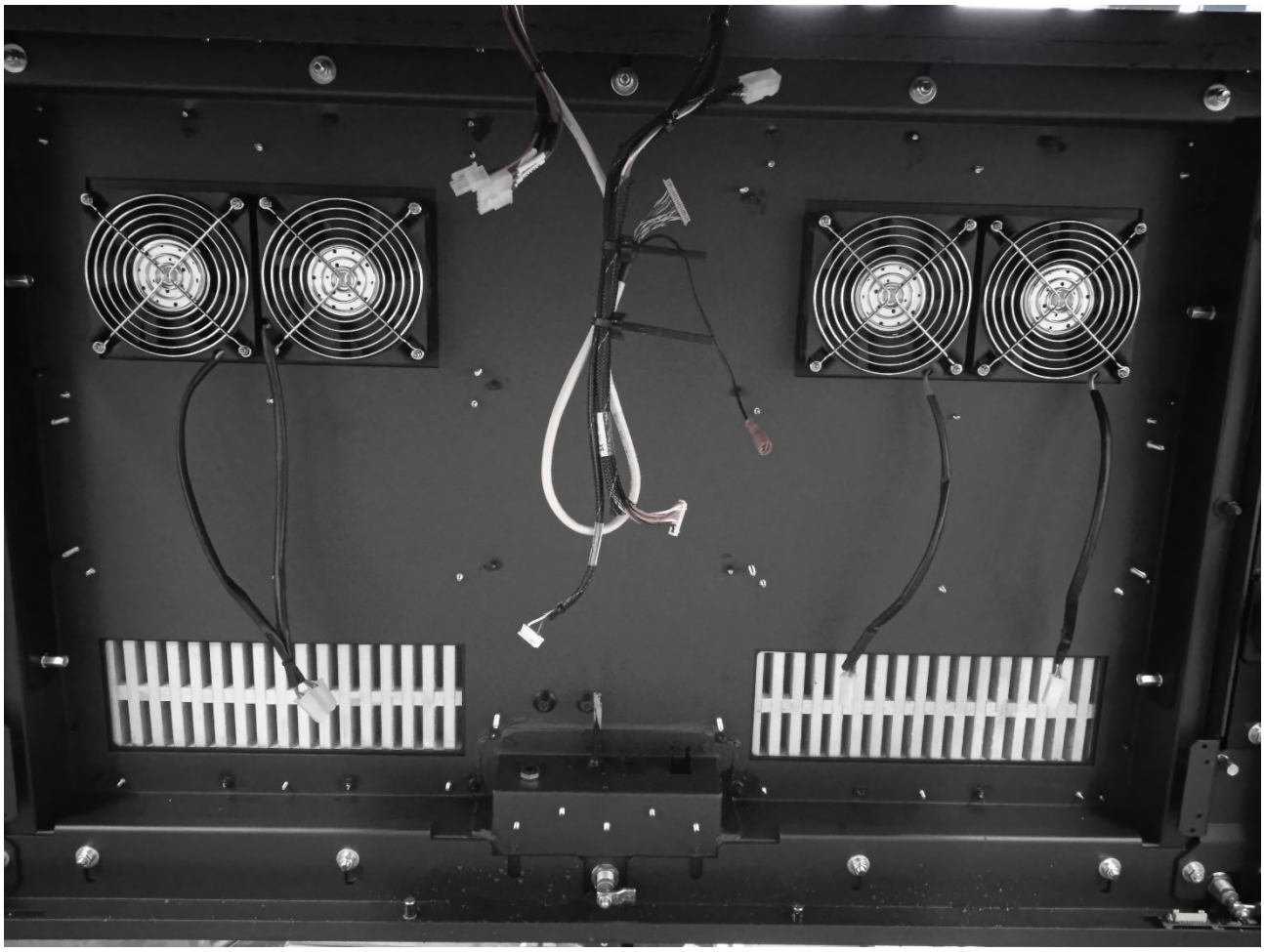
The requirements are: **Fulfilled.**
At the end of test no presence of water has been found inside the enclosures and on live parts. See picture 5.3 for details

Remarks and/or Deviations: None

5.3 Photographs of equipment after IP test

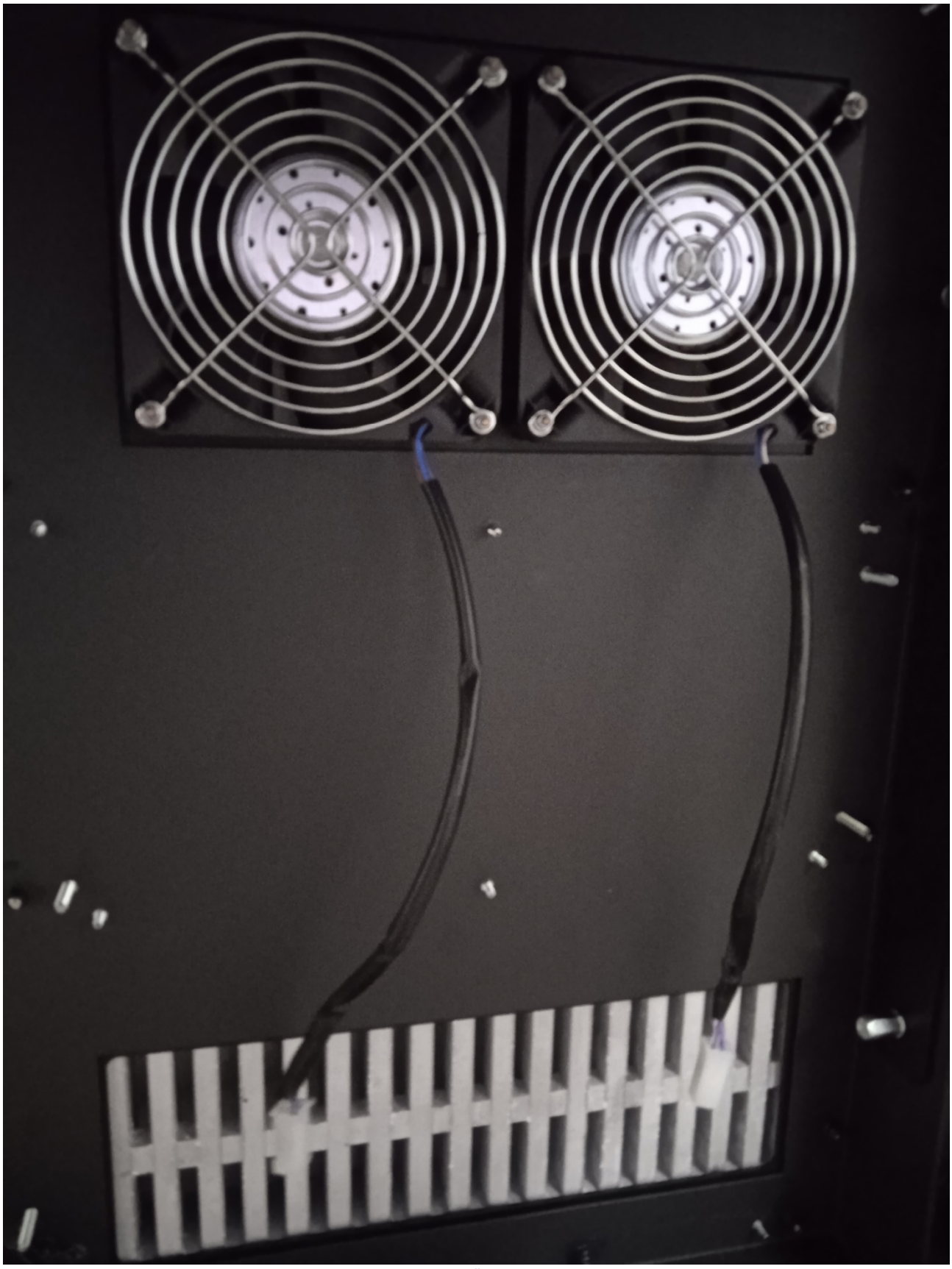


a)



b)

c)



d)

Figure 3: from a) to d) EuT after IPX5 tests

6 TEST EQUIPMENT

Equipment	Manufacturer	Model	Serial N°
Rigid steel	ATS	1.06	042/18
Data Logger	Testo	175-H2	20012380/305
Barometer	Testo	176P1+0572 6174	41002029+20638516
Flowmeter	Cryotek	D4 (21 l/min)	97061114-15
Spray nozzle IPX5	ATS	IPX5	492
Tape measure	Stanley	5 m	33-720
Dust chamber	Attrezzature Tecniche Speciali	3.03	00/567-96
Timer	Tim	1/100”	1.39
Multimeter with thermocouple K	Fluke	189 + TcK	90550240 0.0759

7 PHOTOS

a)

b)

Figure 4: a) and b) Eut general view

-End of test report -